Introduction to Swirles

and Intel GPUs in general

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What is Swirles?

- Swirles is our new HPC cluster and the successor to Fawcett.
- The Intel components are named Cosmos XI
  - 3 nodes of Intel Data Center GPU Max 1550 (PVCs) hosted on Sapphire Rapids
  - 4 x 2 ‘slices’ per node
- There are also NVIDIA and AMD (CPU) components as well.
- Funded by ExCALIBUR as a GPU testbed (open to all UK researchers)
- For now, we haven’t worked out a fair usage policy, expect this to change in the future

Access to Swirles

- Logging in:
  - ssh username@ssh.maths.cam.ac.uk
  - ssh username@sw-pvc0X.maths.cam.ac.uk where the X is 1, 2 or 3.
- Your username is your CRSid, the password is your usual Maths password for logging into your desktop or Fawcett
- How to check if you have a login (how long your account is valid for):

  https://useradmin.maths.cam.ac.uk/selfservice/record
- Don’t panic if you can’t login! Stephen has some credits on the Intel Developer Cloud.

The Swirles environment

- Swirles uses a module system, like on Fawcett.
- No modules are loaded by default (try doing a module list)
- The Intel oneAPI HPC toolkit is available as modules - this is what you'll be using today.
  - module load intel/compiler-intel-llvm/2024.2.0
  - module load intel/mpi/2021.13
  - module load intel/mkl/2024.2
- The OS is Ubuntu 22.04
- Editors are vi or nano
  - Some quick vi pointers:
    - Type 'i' to enter insert/edit mode, press 'esc' to exit
    - Type ':w' to save changes
    - Type ':q' to save and quit, ':q!' to force quit without saving

Slurm on Swirles

How to submit jobs

- You can use mpirun directly from the node (for now…) or you can use Slurm to queue a job (recommended)
- Example Slurm commands:
  - `srun -p pvc  --nodes=1 --mpi=pmi2 --cpus-per-task=28 --gres=gpu:1 <name of program>`
  - or write a batch script and use `sbatch <name of script>`
- If using mpirun directly, use the option -- bootstrap=fork (this will expose the tiles as separate devices).

Example environment setup

source /local/scratch/public/swirles-env.sh

```
#!/bin/bash

module load intel/compiler-intel-llvm/2024.2.0
module load intel/mpi/2021.13
module load intel/mkl/2024.2

export I_MPI_PMI_LIBRARY=/usr/lib/x86_64-linux-gnu/libpmi2.so  #this points Slurm to the API (PMI-2) for launching MPI jobs
export I_MPI_OFFLOAD=1                                         #this allows GPU to GPU direct communication via MPI (GPU aware MPI)
unset ZE_AFFINITY_MASK                                         #if this is set, then GPU pinning is automatically disabled
export ZE_FLAT_DEVICE_HIERARCHY=FLAT                           #exposes tiles as separate devices
export I_MPI_OFFLOAD_TOPOLIB=level_zero                        #set interface for GPU topology recognition to level zero
export I_MPI_OFFLOAD_PIN=1                                     #enable GPU pinning (somewhat degenerate with I_MPI_OFFLOAD)
export I_MPI_DEBUG=3                                           #this prints pinning information

alias my_sysmon='watch -n 1 /alt/applic/user-maint/jk945/pti-gpu/tools/sysmon/install/bin/sysmon'
```

This contains all the environment variables you need to run a SYCL program or use MPI enabled GPU communications or use Slurm with multiple GPUs per job

A lot of these settings are from Miren's guide to running GRTeclyn on Dawn: https://github.com/GRTLCollaboration/GRTeclyn/issues/67